

In the claims:

13. (Once amended) A process for selectively adsorbing nitrogen from a gas mixture containing nitrogen and at least one less strongly adsorbed component which comprises contacting the gas mixture with a zone of an adsorbent which is selective for adsorption of nitrogen, selectively adsorbing nitrogen on the adsorbent and discharging the gas mixture minus the adsorbed nitrogen out of the zone wherein the adsorbent comprises a zeolite material containing a molecular structure containing at least one monovalent or divalent atom substituted for at least one trivalent or higher valent atom so that at least one exposed non-framework charge balancing cation is increased in the structure to effect higher nitrogen selectivity over that of a molecular structure having only trivalent or higher valent atoms.

14. (Original) The process of claim 13 wherein the gas is air.

15. (Original) The process of claim 13 wherein the divalent atom is selected from the group comprising zinc, cobalt, iron, magnesium, manganese and beryllium.

16. (Original) The process of claim 13 wherein the divalent atom is zinc.

17. (Original) The process of claim 16-13 wherein the divalent atom is cobalt.

18 (Original) The process of claim 13 wherein said structure is selected from the group comprising EMT, EMT/FAU, BEA, CAN, GME, LTL, MAZ, MOR, MTW, and OFF.

19. (Original) The process of claim 18 wherein said structure is a EMT structure.

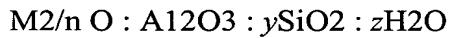
20. (Original) The process of claim 19 wherein said EMT structure has 3 general cation sites I', II and III/III' and said III/III' sites are accessible to gas molecules because of the increase of exposed non-framework charge balancing cations due to the divalent atom substitution for the trivalent atom.

21. (Original) The process of claim 13 wherein said structure is selected from the group comprising Li-ZnEMT, Li-ZnEMT/FAU, Li-ZnBEA, Li-ZnCAN, Li-ZnGME, Li-ZnLTL, Li-ZnMAZ, Li-ZnMOR, Li-ZnMTW and Li-ZnOFF.

REMARKS

The rejections of claims 13-16 under 35 USC 102(b); claims 17 under 35 USC 112 and 35 USC 103(a); and claims 18-21 under 35 USC 103(a) are noted. Claim 17 is amended to correct its depends so that it is now dependent on claim 13.

For background information, both natural and synthetic crystalline aluminosilicates are known and may generally be described as alumino-silicates of ordered internal structure having the following general formula:



where M is a cation, n is its cation, n is its valence, y the moles of silica, and z the moles of the water of hydration.

The crystalline structure of such molecular sieves consists basically of three-dimensional frameworks of SiO₄ and AlO₄ tetrahedra. Isomorphous substitution of boron, gallium or others for aluminum in a zeolite framework may be achieved. The electrovalence of the tetrahedra containing aluminum (or boron, zinc, cobalt) is balanced by the inclusion in the crystal of a cation, e.g., alkali metal (Na, Li, etc.) or other cationic metals and various combinations thereof. These cations are generally readily replaced by conventional ion-exchange techniques.

In the subject claimed invention, a process is disclosed that can produce a zeolite (with EMT structure) composition, e.g., Li₂₀ : pAl₂O₃ : qZnO : ySiO₂ : zH₂O, where Li is the cation that balance the negative charge of zeolite framework. Si, Al, and Zn are framework atoms.

The main argument that for adding zinc to a framework does not lead to benefits in all cases but rather depends on topology and composition. Therefore, it would not be obvious to extend prior art to the other systems.

Claims 13-16 were rejected under 102(b) as being anticipated by MacDougal. The examples cited in MacDougal (5B, 6B, 7B) represent preparation of lithium forms for compositions with FAU topology with zinc in the framework, together with determination of adsorption characteristics. MacDougal describes only materials with the FAU topology as specified in column 19 lines 63-651 "...wherein the composition of matter has a FAU structure and zinc resides in tetrahedral positions in the framework of the FAU structure." It is not obvious to those skilled in the art that zinc incorporation into a zeolite framework in general will result in improved adsorption behavior as a lithium exchanged form. A performance improvement is only predicted for cases where zinc substitution results in increased exposed lithium cation sites. For example, replacement of 10% Al with zinc in lithium Y (still FAU topology) is expected to offer no advantage over the analogous composition that lacks zinc. MacDougal places restrictions on the compositions (Column 19 lines 49-65) to cover only zeolite X (as opposed to X and Y). The subject invention teaches compositions beyond FAU where a performance improvement will occur.

Claim 17 was rejected under 103(a) over MacDougal in view of Coe. MacDougal and Coe are both specific to the FAU structure. Coe refers specifically to a "crystalline X zeolite" which corresponds to an FAU topology. Coe teaches incorporation of cobalt into non-framework sites. Combining Coe and MacDougal represents using the non-framework cation from Coe and introducing it into the framework as described by MacDougal. Again, both cases deal only with FAU topoplogy and it is not obvious to extend to other structures. The improvement, as recited in the subject claim invention, is only expected in cases where introduction of cobalt in the framework increases the exposed cation density. For many topologies and compositions, introduction of cobalt or zinc will not lead to an advantage in adsorption behavior. Therefore, it is not obvious to combine this teaching of MacDougal with Coe, particularly for non-FAU systems.

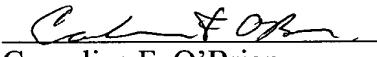
Claims 18-21 were rejected over MacDougal in view of Li. Li does not teach modification of EMT or FAU/EMT to incorporate zinc in framework sites

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but rather introduces zinc at non-framework (ion exchange) sites (Column 10 line 56). Li does describe framework substitution with B or Ga which are both trivalent and therefore do not provide additional ion-exchange capacity relative to Al. For appreciable parts of composition ranges by Li, there would be no advantage for zinc introduction into the framework, particularly for Si/X in the range 1.5 – 2.0. The use of Ca or Zn in non-framework sites as described by Li would further erode the ranges where there might be an advantage. Therefore, it is not obvious to combine MacDougal and Li to produce compositions of using the process of the subject invention.

Claim 17 has been amended to correct its dependency. In light of the above amendment and remarks, reconsideration of the pending application is requested.

Respectfully submitted,


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